

# Composite health behaviour classifier as the basis for targeted interventions and global comparisons in men's health

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## Abstract

**Introduction:** Lifestyle-related diseases are the leading cause of death among North American men. We evaluated health behaviours and their predictors that contribute to morbidity and mortality among Canadian men as a means to making recommendations for targeted interventions.

**Methods:** A cross-sectional analysis of Canadian men drawn from 5362 visitors to our online survey page was conducted. The current study sample of 2000 men (inclusion: male and >18 years; exclusion: incomplete surveys) were stratified to the 2016 Canadian census. The primary outcome was the number of unhealthy men classified using our Canadian Composite Classification of Health Behaviour (CCCHB) score. Secondary outcomes included the number of men with unhealthy exercise, diet, smoking, sleep, and alcohol intake, as well as socioeconomic and demographic factors associated with unhealthy behaviours to be used for targeting future interventions.

**Results:** Only 118/2000 (5.9%) men demonstrated 5/5 healthy behaviours, and 829 (41.5%) had 3/5 unhealthy behaviours; 391 (19.6%) men currently smoked, 773 (38.7%) demonstrated alcohol overuse, 1077 (53.9%) did not get optimal sleep (<7 or >9 hours per night), 977 (48.9%) failed to exercise >150 minutes/week, and 1235 (61.8%) had an unhealthy diet. Multivariate analysis indicated that men with high school education were at increased risk of unhealthy behaviours (odds ratio [OR] 1.58; 95% confidence interval [CI] 1.15–2.18;  $p=0.005$ ), as were men living with relatives (OR 2.10; 95% CI 1.04–4.26;  $p=0.039$ ), or with their partner and children (OR 1.34; 95% CI 1.02–1.76;  $p=0.034$ ).

**Conclusions:** An overwhelming 41.5% of Canadian men had 3/5 unhealthy behaviours, affirming the need for targeted lifestyle interventions. Significant health inequities within vulnerable subgroups of Canadian men were identified and may guide the content and delivery of future interventions.

## Introduction

Health disparities and inequities within Canadian men's health are rarely articulated and poorly understood. Men die prematurely from preventable causes at an unprecedented rate, best reflected by a large potential years of life lost (PYLL) of 3836 per 100 000.<sup>1,2</sup> The etiology of increased mortality among men is unclear, although the evidence suggests that biological, environmental, psychological, and behavioural factors are at play.

Men identify individually with masculine ideals and norms, which guide lifestyle and behaviour choices. Strong alignments to competitiveness and stoicism may heighten men's likelihood of participating in risky behaviours.<sup>3,4</sup> Key health behaviours associated with mortality and morbidity have repeatedly identified lack of exercise, poor diets, smoking, alcohol overuse, and poor sleep to be primary contributors.<sup>5-16</sup> Men demonstrate high rates of alcohol and tobacco use.<sup>17</sup> Canadian men are less likely to consume a healthy diet,<sup>18-22</sup> resulting in high rates of obesity and predisposing them to lifestyle-related chronic diseases.<sup>23</sup> No accepted ideal diet has been identified; however, dietary components associated with negative health outcomes include those high in salt,<sup>24</sup> saturated fats,<sup>25,26</sup> and refined sugar.<sup>27-29</sup> Dietary choices associated with positive health outcomes include mono or polyunsaturated fats intake,<sup>30</sup> and five or more servings of fruits and/or vegetables per day.<sup>31-33</sup> Collectively, the impact of these health behaviours upon chronic disease is significant. Studies have identified compounding risks of mortality and morbidity with each added unhealthy behaviour.<sup>13,16</sup> Studies have predicted that elimination of unhealthy behaviours would prevent 80% of heart disease, stroke, type 2 diabetes and 40% of cancers in the general population.<sup>34,35</sup>

Demographic and socioeconomic status (SES) disparities have been identified to be strongly associated with increased morbidity and mortality.<sup>36-40</sup> This association may, in part, be explained by poor health behaviours, lack of social support

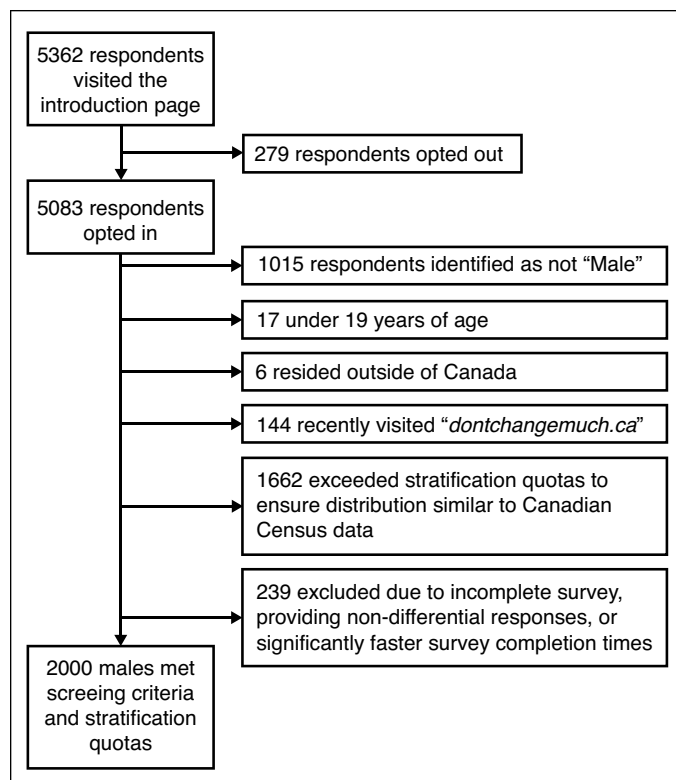
for minorities, and a relative lack of resources among those with low SES. Identifying subgroups of men with dispirit demographics and SES contributing to poor health behaviours in Canada is important to identify those at greatest risk for morbidity and mortality.

An early step to preventing chronic illness and improving quality of life in men involves identifying behaviours as they relate to overall health, including men's health promotion practices (or lack thereof). The objective of the current study was to construct a composite behavioural classification (CCCHB) to quantitate morbidity- and mortality-associated health behaviours among a representative sample of the Canadian male population as a means to guide recommendations for targeted interventions and global comparisons.

## Methods

Institutional review board approval was obtained from the University of British Columbia. Between April 20, 2017 and April 28, 2017, 5362 participants were sourced from an online sample provider and screened to ensure they met inclusion criteria: men aged >18 who were able to read French or English and resided in Canada. The exclusion criteria included an incomplete survey, providing non-differential responses, completing the survey significantly faster than average speed, and respondents not identifying as male. Weighted randomization was used to select 40 000 potential respondents from a large panel, who then received the initial survey invitation. Stratification was performed to ensure that the sample's composition reflected the relative distribution of the Canadian population by age and geography, as determined by the 2016 Canadian Census data.<sup>41</sup> The survey topic was not disclosed in the initial survey invitation, and only potential respondents who went to the survey introduction page were advised that the focus was on health behaviours (Fig. 1). Informed consent was obtained prior to completing the survey. In total, 2000 men met study criteria and were included in the final analysis. Demographic variables were collected, including: age, minority status, employment status, household income, sexual orientation, province of residence, living arrangement, education level, and medical comorbidities.

The survey consisted of five distinct sections, including: geographic sampling, demographic profiling, men's health literacy, men's health stigma, and men's health behaviours. The survey consisted of 94 questions dispersed among the five sections and was estimated to take respondents 15 minutes in total duration. Question types included Likert scales and multiple-choice designs.



**Fig. 1.** Among 5362 Canadians that visited the survey page, only 2000 met inclusion and exclusion criteria. Of note, 144 patients were excluded for visiting "dontchangemuch.ca," which is a website created by the Canadian Men's Health Foundation aimed to address many of these health behaviours; these men were excluded to prevent bias in selecting men actively pursuing healthy behaviour and lifestyle changes.

## Health behaviours

We assessed the established key health behaviours that are known to impact male morbidity and mortality. To do this, we used a priori evidence-based thresholds to classify behaviours as being 'healthy' vs. 'unhealthy.'

### Smoking

Participants were asked about their cigarette smoking habits based upon questions adapted from the Canadian Tobacco Use Monitoring Survey (CTUMS).<sup>42</sup> Men were classified as healthy if they were non-smokers or ex-smokers.

### Alcohol

Participants were administered the validated Audit-C screening questionnaire,<sup>43</sup> which functions with a sensitivity of 0.86 and specificity of 0.89 when used as a screening tool for alcohol overuse among men.<sup>44</sup> A score of <4 was considered healthy.

### Sleeping

Participants were asked the duration of sleep obtained each night based upon the Canadian Health Measures Survey

(CHMS).<sup>45</sup> Men sleeping seven or eight hours per night were classified as healthy in accordance with the National Sleep Foundation's updated sleep duration recommendations<sup>46</sup> and literature consensus that demonstrates optimal health outcomes associated with seven hours sleep per night.<sup>47-49</sup>

### Exercise

The validated Godin Leisure-time exercise questionnaire,<sup>50</sup> designed to assess exercise behaviour in the community,<sup>51</sup> was administered to participants. Men achieving at least 150 minutes of moderate to strenuous exercise per week were classified as healthy, in accordance with the Canadian Physical Activity Guidelines for 18–64-year-olds,<sup>52</sup> 65+-year-olds,<sup>53</sup> and available literature.<sup>54</sup>

### Diet

Participants were asked about their weekly frequency of food consumption. Unhealthy foods were defined as those identified in the literature to be associated with negative health outcomes, including foods high in salt,<sup>24</sup> saturated fats,<sup>25,26</sup> and refined sugar.<sup>27-29</sup> Healthy foods were defined as those associated with positive health outcomes and included those high in mono or polyunsaturated fats,<sup>30</sup> as well as five or more servings of fruits and/or vegetables per day.<sup>31-33</sup> Lower frequencies of unhealthy food choices and higher frequencies of healthy food choices resulted in greater scores. Men with a composite score >11 of a maximum score of 15 were classified as healthy. This questionnaire was adapted from the 'youcheck' tool, with the addition of a refined sugar component.<sup>55</sup>

### Total health behaviour classification

Men were classified as 'very healthy' if they demonstrated no unhealthy behaviours; 'healthy' if they had one unhealthy behaviour; 'borderline' if they had two unhealthy behaviours; and 'unhealthy' if they had 3–5 unhealthy behaviours. These categories were then dichotomized into a combined group of 'very healthy, healthy, borderline' group and an 'unhealthy' group. This division was based upon previous work, where 0–2 unhealthy behaviours has been used as the referent healthy group, validated by increased mortality among men and women with additional unhealthy behaviours.<sup>13</sup>

### Statistical analysis

Descriptive analysis was performed to identify the number of men with healthy and unhealthy classification of behaviours. Multivariate logistic regression was performed to analyze predictive factors for our dichotomized categories of healthy behaviour. The most populous categories were chosen as the referent within each sub group. All analyses were unadjusted. A two-tailed p value of <0.05 was considered significant. Statistical analyses were performed using Stata 14.1.

## Results

Sample demographic characteristics are reported in Table 1. The frequency of men's engagement with these unhealthy behaviours is described in Table 2.

Our findings reveal that only 5.9% (118/2000) of Canadian men engaged in all five healthy behaviours and

**Table 1. Baseline respondent characteristics and demographics**

| Demographics and baseline characteristics          | Number of participants (%) |
|--|----------------------------|
| Sex  |                            |
| Male   | 2000 (100)                 |
| Age  |                            |
| 19–29  | 379 (19.0)                 |
| 30–54  | 934 (46.7)                 |
| 55+  | 687 (34.4)                 |
| Province   |                            |
| British Columbia                                   | 265 (13.3)                 |
| Alberta  | 217 (10.9)                 |
| Saskatchewan                                       | 131 (6.6)                  |
| Ontario  | 768 (38.4)                 |
| Quebec   | 476 (23.8)                 |
| Martime provinces                                  | 142 (7.1)                  |
| Territories  | 1 (0.1)                    |
| Minority   |                            |
| Yes  | 218 (10.9)                 |
| No   | 1782 (89.1)                |
| Household income                                   |                            |
| <\$20 000  | 129 (6.5)                  |
| \$20 000–39999                                     | 282 (14.1)                 |
| \$40 000–59 999                                    | 336 (16.8)                 |
| \$60 000–79 999                                    | 355 (17.8)                 |
| \$80 000–99 999                                    | 278 (13.9)                 |
| \$100 000–119 999                                  | 222 (11.1)                 |
| \$120 000–139 999                                  | 134 (6.7)                  |
| \$140 000 or more                                  | 264 (13.2)                 |
| Highest level of education                         |                            |
| Primary school or less                             | 6 (0.3)                    |
| Some high school                                   | 48 (2.4)                   |
| High school graduate                               | 301 (15.1)                 |
| Some college/trade school                          | 225 (11.3)                 |
| Graduated college/trade school                     | 422 (21.1)                 |
| Some university                                    | 175 (8.8)                  |
| University undergraduate degree                    | 495 (24.8)                 |
| University graduate degree                         | 328 (16.4)                 |
| Sexual preference                                  |                            |
| Heterosexual                                       | 1805 (90.3)                |
| Homosexual   | 118 (5.9)                  |
| Bisexual   | 48 (2.4)                   |
| Not sure or questioning                            | 25 (1.3)                   |
| Other  | 4 (0.2)                    |
| Number of children age <19 living with participant |                            |
| None   | 1623 (81.2)                |
| 1  | 177 (8.9)                  |
| 2  | 140 (7.0)                  |
| 3  | 42 (2.1)                   |
| 4+   | 18 (0.9)                   |

**Table 1 (cont'd). Baseline respondent characteristics and demographics**

| Demographics and baseline characteristics | Number of participants (%) |
|---|----------------------------|
| Living arrangement                        |                            |
| Partner                                   | 818 (40.9)                 |
| Alone                                     | 449 (22.5)                 |
| Partner & children                        | 392 (19.6)                 |
| Parent                                    | 178 (8.9)                  |
| Non-relatives                             | 54 (2.7)                   |
| Children                                  | 49 (2.5)                   |
| Relatives                                 | 41 (2.1)                   |
| University or college campus              | 14 (0.7)                   |
| Other                                     | 5 (0.3)                    |
| Employment                                |                            |
| Employed full-time                        | 1003 (50.2)                |
| Employed part-time                        | 155 (7.8)                  |
| Self-employed                             | 170 (8.5)                  |
| Looking for employment                    | 93 (4.7)                   |
| Unable to work                            | 63 (3.2)                   |
| Retired                                   | 453 (22.7)                 |
| Studying full-time                        | 108 (5.4)                  |
| Studying part-time                        | 47 (2.4)                   |
| Home caregiver                            | 14 (0.7)                   |
| Total number of participants              | 2000 (100)                 |

21.9% (437/2000) engaged in 4/5 so as to be classified as healthy. More than a quarter of the men had 3/5, or borderline healthy behaviours (30.8%; 616/2000), and 41.5% (829/2000) of men were classified as unhealthy with 0–2/5 healthy behaviours. Table 2 shows which unhealthy behaviours contributed to each of the CCCHB classifications. The most common unhealthy behaviours included poor sleep, lack of exercise, and poor diet.

With respect to smoking, 1609 (80.5%) of men reported healthy smoking behaviours, with 1052 (52.6%) non-smokers and 557 (27.9%) ex-smokers. The remaining 391

(19.6%) men were classified as unhealthy, with 145 (7.3%) occasional smokers and 246 (12.3%) regular smokers.

Audit-C questionnaire results identified 1227 (61.4%) men reporting healthy drinking habits, while 773 (38.7%) reported behaviours that screen positively for alcohol overuse.

Less than half, 923 (46.2%) men slept a healthy 7–9 hours/night. Among the 1077 (53.9%) of men that reported unhealthy sleeping behaviours, 994 (92.3%) under-slept and 83 (7.7%) overslept.

Only 1023 (51.2%) men met the criteria of at least 150 minutes of moderate to strenuous activity/week, while 977 (48.9%) did not exercise enough. Most concerning, 20% of men were sedentary, reporting no moderate exercise.

One-third (765; 38.3%) of men were classified as consuming a healthy diet, receiving a score of 12/15 or greater, while 1235 (61.8%) were classified as having unhealthy eating. Most of these men consumed a lack of vegetables/fruits and mono-polyunsaturated fats rather than excessive refined sugars, and sodium-laden processed foods.

Multivariate logistic regression revealed that men with high school education were at increased risk of unhealthy behaviours (odds ratio [OR] 1.58; 95% confidence interval [CI] 1.15–2.18;  $p=0.005$ ), as were men living with relatives (OR 2.10; 95% CI 1.04–4.26;  $p=0.039$ ) or with their partner and children (OR 1.34; 95% CI 1.02–1.76;  $p=0.034$ ) (Table 3).

## Discussion

Creation of the CCCHB included behaviours directly associated with morbidity and mortality; when available, validated questionnaires and evidence-based a priori thresholds were used. Classification of Canadian men using our CCCHB identified that 94.1% of men have at least one unhealthy behaviour amenable to modification. Most concerning is that nearly half of men demonstrate

**Table 2. Distribution of unhealthy behaviour categories based upon the total health behaviour classification**

| Total health behaviour classification | Health classification  | Total men (%)   | Men classified as “unhealthy” (%) per category |                |                |                |                |
|---------------------------------------|------------------------|-----------------|--|----------------|----------------|----------------|----------------|
|                                       |                        |                 | Smoking  | Alcohol        | Sleep          | Exercise       | Diet           |
| Very Healthy                          | 0 unhealthy behaviours | 118/2000 (5.9)  | 0 (0)  | 0 (0)          | 0 (0)          | 0 (0)          | 0 (0)          |
| Healthy                               | 1 unhealthy behaviour  | 437/2000 (21.9) | 12/437 (2.7)                                   | 84/437 (19.2)  | 137/437 (31.4) | 74/437 (16.9)  | 130/437 (29.7) |
| Borderline                            | 2 unhealthy behaviours | 616/2000 (30.8) | 55/616 (8.9)                                   | 205/616 (33.3) | 297/616 (48.2) | 293/616 (47.6) | 382/616 (62.0) |
| Unhealthy                             | 3 unhealthy behaviours | 571/2000 (28.5) | 140/571 (24.5)                                 | 281/571 (49.2) | 418/571 (73.2) | 394/571 (69.0) | 480/571 (84.0) |
|                                       | 4 unhealthy behaviours | 219/2000 (11.0) | 145/219 (66.2)                                 | 164/219 (74.9) | 186/219 (84.9) | 177/219 (80.8) | 204/219 (93.2) |
|                                       | 5 unhealthy behaviours | 39/2000 (2.0)   | 39/39 (100)                                    | 39/39 (100)    | 39/39 (100)    | 39/39 (100)    | 39/39 (100)    |

For each group of men with a number of unhealthy behaviours (0–5), a breakdown is provided demonstrating the number (%) of men with each type of unhealthy behaviour.

**Table 3. Multivariate analysis of demographic, socioeconomic, and comorbid conditions impacting total health behaviour classification**

| Predictors of unhealthy total health behaviour                  | Odds ratio (95% CI) | p      |
|---|---------------------|--------|
| Demographics  |                     |        |
| Minority  | 1.01 (0.74–1.38)    | 0.949  |
| Young age   | 1.00 (0.99–1.01)    | 0.699  |
| Employment status (employed full-time reference)                |                     |        |
| Employed part-time  | 0.76 (0.49–1.16)    | 0.202  |
| Looking for employment  | 0.62 (0.38–1.02)    | 0.061  |
| Unable to work  | 1.38 (0.75–2.51)    | 0.290  |
| Retired   | 0.63 (0.45–0.88)    | 0.007* |
| Student full-time   | 0.59 (0.36–0.96)    | 0.034* |
| Student part-time   | 0.51 (0.26–1.00)    | 0.049* |
| Home caregiver  | 3.39 (0.67–17.24)   | 0.142  |
| Orientation (heterosexual reference)                            |                     |        |
| Gay or lesbian  | 1.13 (0.82–1.56)    | 0.464  |
| Living location (Ontario reference)                             |                     |        |
| British Columbia  | 0.74 (0.54–1.01)    | 0.054* |
| Alberta   | 1.00 (0.73–1.37)    | 0.986  |
| Saskatchewan & Manitoba   | 1.08 (0.73–1.60)    | 0.698  |
| Quebec  | 1.01 (0.79–1.29)    | 0.954  |
| Atlantic provinces & territories                                | 0.92 (0.63–1.35)    | 0.665  |
| Living arrangement (living with partner reference)              |                     |        |
| Alone   | 1.03 (0.79–1.36)    | 0.809  |
| Parent  | 1.07 (0.71–1.60)    | 0.752  |
| Partner & children  | 1.34 (1.02–1.76)    | 0.034* |
| Non-relatives   | 1.35 (0.74–2.48)    | 0.328  |
| Children  | 1.36 (0.74–2.50)    | 0.325  |
| Relatives   | 2.10 (1.04–4.26)    | 0.039* |
| University or college campus                                    | 0.60 (0.17–2.12)    | 0.432  |
| Other   | 1.31 (0.19–8.88)    | 0.782  |
| Highest level of education (university undergraduate reference) |                     |        |
| Primary school  | 0.77 (0.13–4.59)    | 0.777  |
| Some high school  | 1.48 (0.13–4.59)    | 0.228  |
| High school graduate  | 1.58 (1.15–2.18)    | 0.005* |
| Some college/trade school                                       | 1.23 (0.87–1.73)    | 0.235  |
| Graduated college/trade school                                  | 1.09 (0.82–1.44)    | 0.563  |
| Some university   | 0.98 (0.67–1.43)    | 0.908  |
| University graduate degree                                      | 0.86 (0.64–1.17)    | 0.341  |

\*Statistically significant predictor variable  $p < 0.05$ . CCCHB total health behaviour classification is dichotomized into: very healthy, healthy, borderline vs. unhealthy. CI: confidence interval.

3–5/5 unhealthy behaviours. A cumulative effect of each additional unhealthy behaviour has been associated with increased mortality risk; in one series, hazard ratios (HR) sequentially increased from 1.37 to 6.15 as the number of unhealthy behaviours increased.<sup>56,57</sup> To understand the behaviours contributing to CCCHB, we also assessed each behaviour independently.

**Table 3 (cont'd). Multivariate analysis of demographic, socioeconomic, and comorbid conditions impacting total health behaviour classification**

| Predictors of unhealthy total health behaviour | Odds ratio (95% CI) | p     |
|--|---------------------|-------|
| Household income (\$60 000–79 999 reference)   |                     |       |
| \$19 999 or less                               | 1.13 (0.71–1.82)    | 0.595 |
| \$20 000–39 999                                | 0.95 (0.68–1.34)    | 0.785 |
| \$40 000–59 999                                | 1.33 (0.97–1.84)    | 0.076 |
| \$80 000–99 999                                | 1.12 (0.81–1.56)    | 0.494 |
| \$100 000–119 999                              | 0.71 (0.49–1.03)    | 0.068 |
| \$120 000–139 999                              | 0.71 (0.72–1.69)    | 0.650 |
| \$140 000 or more                              | 0.83 (0.58–1.19)    | 0.313 |

\*Statistically significant predictor variable  $p < 0.05$ . CCCHB total health behaviour classification is dichotomized into: very healthy, healthy, borderline vs. unhealthy. CI: confidence interval.

A sizable portion of men (53.9%) did not achieve healthy sleep (7–9 hours). Thus, more than half of Canadian men with poor sleep behaviours are at increased risk for mortality and significant comorbidities, such as cardiovascular disease, stroke, diabetes, cancer, and inflammatory states.

In our study population, only 51% of men met the minimal 150 minutes of weekly exercise as recommended by the Canadian Society of Exercise Physiology<sup>58</sup> and the U.S. Department of Health physical activity guidelines for Americans.<sup>59</sup> An 11-year longitudinal study of 12 201 older men demonstrated that those meeting this threshold had decreased risk of mortality (HR 0.74).<sup>54</sup> An inverse relationship between exercise duration and mortality has been described in a multitude of studies.<sup>60</sup> Specifically, exercise is associated with a decreased risk of conditions that heavily contribute to mortality among western nations, including: cancers,<sup>61</sup> cardiovascular disease,<sup>62</sup> hypertension,<sup>62</sup> hyperlipidemia,<sup>62</sup> metabolic syndrome, obesity, diabetes mellitus,<sup>62</sup> and suicidal ideation.<sup>63</sup> Nearly half of the current study respondents reported inadequate exercise, which by extension, exposed them to modifiable risks for a multitude of preventable disease, morbidity, and early mortality.

A healthy diet is difficult to define from the literature,<sup>64</sup> in part because there have been no long-term comparative studies to place the merits of all available diets against each other.<sup>65</sup> However, there are common dietary principles associated with health-related outcomes. We defined unhealthy dietary items as those associated with negative health outcomes in the literature. These included dietary items high in salt,<sup>24</sup> saturated fat<sup>25,26</sup> and refined sugar,<sup>27–29</sup> which are independently associated with morbidity and mortality, including increased risk of cardiovascular disease and cancers.<sup>66–69</sup> Diets rich in vegetables<sup>31</sup> and mono- and polyunsaturated fats<sup>30</sup> have been associated with reduced risk of cardiovascular disease, neurodegenerative disease, diabetes, and numerous cancers.<sup>67,70–72</sup> Our results identify that nearly

two-thirds of the respondents had unhealthy diets, placing themselves at unnecessarily high risk for morbidity and mortality. These findings are supported by previous literature, where many men exhibit diets higher in fat, meat, and salt with less vegetables, fruit, and fiber.<sup>22</sup>

Only a minority (19.6%) of the respondents were current smokers, in keeping with national rates,<sup>73</sup> and 27.9% of men were ex-smokers, supporting previous findings that smoking rates are declining in Canada and globally.<sup>74</sup> The literature characterizing the negative impact of smoking on health outcomes is strong and longstanding. Smoking is associated with cardiovascular disease, numerous cancers, pulmonary disease, and significantly increased mortality. Smoking is thought to contribute 30–39% of behaviour-mediated loss of life expectancy.<sup>75</sup> Given the impact of smoking on health outcomes, it is imperative for efforts to continue to decrease the rate of smokers and prevent premature death and morbidity.

We identified alcohol overuse in 38.7% of Canadian men. This is higher than previous studies among Canadian men, which identified 29.0% of adult men to be heavy drinkers.<sup>76</sup> This is concerning since alcohol overuse has been associated with self-inflicted injuries, homicide, liver disease, cancers, neuropsychiatric disease, and cardiovascular disease.<sup>77</sup>

Our study has uniquely assessed the contribution of demographic and socioeconomic factors contributing to health behaviours among Canadian men. Men with a high school graduate level of education were at greater risk of unhealthy behaviours compared to men with undergraduate degrees. Increased education has consistently demonstrated healthier behaviours and lifestyle,<sup>78</sup> and is integral to future health promotion. A trend also existed for reduced household income and poorer CCCHB classification, suggesting behaviours among men of lower SES likely contribute to the disparities of increased morbidity and mortality.<sup>79</sup>

Men living with relatives or with their partner and children engaged in fewer healthy behaviours compared to men living only with their partners. Previous studies have also shown that men living with their partner have better health behaviours and overall health.<sup>80,81</sup> We postulate that men living with extended families may face additional time and financial constraints, precluding opportunities to optimize health behaviours.

In our model, retired men had healthier behaviours compared to men working full-time. Men working full-time likely face increased time constraints and fatigue associated with work, resulting in decreased time to focus on self-health and resulting in more unhealthy behaviours.<sup>82</sup> Interestingly, both part-time and full-time students demonstrated healthier behaviours, which may be due to increasing trends of dietary and exercise health awareness and education.<sup>83</sup> However, these results contrast with older publications, suggesting that today's students may be making greater strides to live healthier lives.

The strengths of our study include the creation and use of a composite CCCHB classification system, which includes evidence-based health behaviours and respective thresholds associated with morbidity and mortality. Limitations include potential recall biases, which are difficult to eliminate in self-reporting surveys such as ours. Given our aim was to capture current behaviours, this bias may be less of an issue. Our survey was conducted via an online platform, which may not be accessible to all Canadians who were not technologically savvy enough to access the survey, potentially introducing a selection bias.

## Conclusion

It is fair to say that the 'problems' of men's health behaviours have attracted significant attention. The current study confirms the rhetoric in this regard, with the majority of men reporting multiple unhealthy behaviours. Specifically, ever present is the need to attend to disparities and health inequities among men, wherein greater resources might be directed toward men of lower SES to enhance their likelihood of making positive health behaviour adjustments. In addition, given that unhealthy lifestyles comprise behaviour, there might be significant benefit in advocating and empowering men for small changes to an array of health practices — as distinct from abstracting and making wholesale changes to one behaviour, as advocated by the Canadian Men's Health Foundation (*dontchangemuch.ca*). Although findings and recommendations from our study are representative of Canadian men, adoption of this composite classification may also provide a much-needed platform for comparisons among global populations and in longitudinal outcomes assessment following programmatic interventions.

**Competing interests:** Dr. Flannigan has been a medical advisor for the Canadian Men's Health Foundation, and has participated in a clinical trial on antibiotic duration post-struvite stone treatment supported by UBC and a trial on SSRI impact on sperm DNA fragmentation supported by Weill Cornell. Dr. Oliffe has received honoraria from Pfizer and owns shares in Johnson & Johnson. The remaining authors report no competing personal or financial interests related to this work.

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